# ELEC 262 - Introduction to Waves and Photonics - Spring 2016

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## Overview

This is a first course on waves, optics, and photonics, intended for sophomores. Topics to be covered include basic wave phenomena with an emphasis on electromagnetic waves, geometric optics, the interaction of light with matter, and interference and diffraction effects. We will also have time to cover a selected number of more advanced topics including laser physics, Fourier optics, and fiber optics.

## Prerequisites

The curriculum for ELEC 262 assumes a basic level of understanding of electricity and magnetism, at the level of Physics 102. This includes at least a passing familiarity with Maxwell's equations and with the differential vector calculus notation used to express them (i.e., div, grad, curl and all that). You will also need to be very comfortable with complex numbers: if exp(j x) intimidates you, then you will have a rough time in this class.

## Course Schedule

This schedule is tentative and may be updated as the semester goes along.

| Week | Dates | Lectures | Subjects | Comments |
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| 1 | Jan. 11, 13, 15 | 1, 2, 3 | Wave Basics | |
| 2 | Jan. 20, 22 | 4, 5 | Electromagnetic Waves; Interaction of Light with Matter | Jan. 18th is MLK Day |
| 3 | Jan. 25, 27, 29 | 6, 7, 8 | Interaction of Light with Matter | |
| 4 | Feb. 1, 3, 5 | 9, 10, 11 | Optics of Metals; Scattering of Light | |
| 5 | Feb. 8, 10, 12 | 12, 13, 14 | Reflection, Refraction, Evanescent Waves | Exam 1 this week (covers lectures 1-10) |
| 6 | Feb. 15, 17, 19 | 15, 16, 17 | Polarization | |
| 7 | Feb. 22, 24, 26 | 18, 19, 20 | More Polarization; Group Velocity;Fourier Optics | |
| 9 | March 7, 9, 11 | 21, 22, 23 | Fourier Optics | |
| 10 | March 14, 16, 18 | 24, 25 | Geometrical Optics | Exam 2 in class on Friday (covers lectures 11-22) |
| 11 | March 21, 23, 25 | 26, 27, 28 | Gaussian Beams | |
| 12 | March 28, 30 | 29, 30 | Waveguides; Diffraction | |
| 13 | Apr. 4, 6, 8 | 31, 32, | Diffraction; Coherence and | |

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| | | 33 | Interference | |
| 14 | Apr. 11, 13, 15 | 34, 35, 36 | More Interference; Lasers | |
| 15 | Apr. 18, 20, 22 | 37, 38, 39 | Non-Linear Optics | Exam 3 this week (covers lectures 23-35) |

**Textbook**
The required text is *Optics*, 4th edition, by Eugene Hecht. You can buy it used, but be sure to get the 4th edition and not an earlier one. **WARNING:** often, someone makes the mistake of purchasing an earlier edition of the book. Note that the homework problems are not the same in earlier editions! If you use the wrong book and end up doing the wrong reading assignments or homework problems (i.e., not what was assigned), you will not get credit or sympathy.

**Problem Sets**
Problem sets will be handed out on Fridays (most weeks), and will usually be due IN CLASS the following Friday. You are permitted to work with fellow students in solving the problems, as long as your collaboration is compatible with the Rice Honor Code (e.g., copying someone else's work is not allowed).

**Office Hours**
Office hours will be held in Abercrombie Laboratory A127, on Tuesdays between 1:00 and 2:30pm. You are *strongly* encouraged to take advantage of office hours, especially if you are having difficulty completing the problem sets in a reasonable amount of time. Additional office hours may be scheduled by appointment. Email to make an appointment. ***Please* take advantage of this**.

**Words of Advice**
Like most classes in the sciences and engineering disciplines, each lecture in this class builds on concepts from the previous ones. In other words, in week 2 we will rely very heavily on what we discussed in week 1, and so on. The consequence of this is significant: if you get lost in week 1, you will certainly be lost in weeks 2, 3, 4, etc. So it is *crucial* that you don't get lost or fall behind, especially early in the semester. If you feel that you are failing to grasp something important at any time, but especially during the first several weeks, do not hesitate to ask me for help. Note that performance evaluations, including the problem sets and the midterm exams, are focused on your ***understanding of the concepts*** discussed in lecture, ***not on memorization*** of formulas. To do well in the class, you need to understand the concepts well. Don't get left behind if you miss something - ASK FOR HELP.

**Exams**
There will be two midterms and a comprehensive final exam. More details on the nature of the exams, and the scheduling, will be forthcoming. If you anticipate that you might miss an exam, let me know AS SOON AS POSSIBLE so that an alternative can be arranged for you. If you have a foreseeable conflict, you MUST let me know in advance of the exam date. Unforeseeable conflicts will be dealt with on a case-by-case basis.

**Grading Policy**
Your final grade will be determined according to the following weights:

- Homework: 25%
- Three exams: 25% each

There will be NO final exam.

Please note that this class will NOT be graded on a curve. It is possible for everybody in the class to get an A (or an F). Your grade has no influence on anybody else's grade.

**Graders**
Click here for information on the graders.

*Policy on teaming:* It is obvious that, in finding a way to understand the concepts presented in lecture and in the homework assignments, your classmates can be one of the most valuable resources you can find. Therefore, working together as a group to complete homework assignments is reasonable. However, the point of the homework assignments is to teach you about optics, not about copying solutions. Direct copying of solutions provided by another student (or from any other source) is therefore a violation of the Honor Code, and is strictly forbidden.

*Regrade policy:* If you think a regrade is required on any assignment, you should make an appointment with me AS SOON AS POSSIBLE, but not more than one week after the assignment or exam was returned to you. Except in the event of obvious clerical errors, NO regrades will be considered beyond this deadline. It is YOUR responsibility to examine your graded papers carefully to check for any grading errors.

*Late assignments:* If you have a LEGITIMATE and FORSEEABLE excuse for handing in an assignment late, you will receive permission to do so with no penalty. These situations will be handled on a case-by-case basis. Note that a legitimate excuse such as a medical situation requires a confirming note from your physician. If you do not fall into the aforementioned category, then you can still receive 50% credit on late problem sets, as long as I receive them no later than two weeks after the original due date. Assignments turned in later than that will receive 25% credit, up to the last day of class. The idea here is that, even if you cannot hand in an assignment on time, you still get some credit if you do it before the end of the semester. This is the Better Late Than Never clause. Obviously, using the homework solutions to complete a late assignment would defeat the whole purpose of this clause, so it is a violation of the Honor Code to do so.

**Handicapped students**
Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All discussions will remain confidential. Students with disabilities should also contact Disability Support Services in the Allen Center, at 348-5841.

**ABET Course Outcomes**
Expected course outcomes